NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

CRITICAL AREA PLANTING

(Acre)

CODE 342

DEFINITION

Establishing permanent vegetation on sites that have or are expected to have high erosion rates and that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal practices.

PURPOSE

- Stabilize areas with existing or expected high rates of soil erosion by water.
- Restore degraded sites that cannot be stabilized through normal methods.

CONDITIONS WHERE PRACTICE APPLIES

On areas with existing or expected high rates of erosion or degraded sites that usually cannot be stabilized by ordinary conservation treatment and/or management, and if left untreated, could be severely damaged by erosion or sedimentation or could cause significant off-site damage (i.e., cuts, fills, surface mined areas, and denuded or gullied areas where vegetation is difficult to establish by usual planting methods).

CRITERIA

General Criteria Applicable to All Purposes

Species selected for seeding or planting shall be suited to current site conditions and intended uses. Selected species will have the capacity to achieve adequate density and vigor within an acceptable time frame to stabilize the site sufficiently to permit suited uses with ordinary management activities.

Site preparation and seeding or planting shall be done at a time and in a manner to ensure survival and growth of the selected species. Only viable, high quality, and adapted seed or planting stock will be used.

Establish a temporary cover crop or mulch the area if seeding dates are not conducive to seeding perennial vegetation. The cover crop can serve as mulch for the perennial vegetation. Apply all nutrients at time of seeding cover crop. Split N applied when more than 60 pounds of N is recommended. Fertilization, mulching, or other facilitating practices for plant growth shall be timed and applied to accelerate establishment of selected species.

Additional Criteria to Restore Degraded Sites

If gullies or deep rills are present, they will be shaped, if feasible, to allow equipment operation and ensure proper site and seedbed preparation. Soil amendments will be added as necessary to improve or eliminate physical or chemical conditions that inhibit plant establishment and growth.

CONSIDERATIONS

Consider aspect when planning vegetation and treatment of the site. South and west facing slopes are typically droughty and north and east facing slopes are typically moist.

If livestock are in a critical eroding area, consider rotational grazing or exclusion to adequately address the site. Livestock rub their head on vertical banks. In addition, excessive loafing around shade can cause denuding.

Livestock can be used to reclaim critical eroding areas. During the recommended seeding dates, place livestock at high density (i.e., 40,000 lbs. +/acre). Hoof action tills the soil, low quality hay with seed is unrolled, and high quality hay is unrolled on top. The target is to have one or more manure piles/2 square feet. Remove livestock and allow vegetation to establish.

Consider seeding species or mixes that are native and have multiple values. Avoid species that may harbor pests. Species diversity should be considered to avoid loss of function due to species-specific pests.

When broadcasting seed, sow half rate in one direction, and then seed the other half using another pattern.

Prepare seedbed with lime and fertilizer thoroughly mixed in top four to six inches of soil.

Seeding on fresh dozer tracks is an excellent seeding media. After a rain, tracks require tillage prior to seeding. Consider seeding half of the recommended seeding rate prior to mulching and the remaining half after mulching. See Seeding and Mulching section.

Crimping in mulch or lightly disking mulch will aid in stabilizing mulch.

To scarify steep areas, a harrow or a cedar tree can be cabled between two tractors to manipulate the placement of the harrow.

Gravel surfaces with more than 70 percent of the surface covered with gravel may be seeded without tillage, and mulch is needed.

When establishing land capability classes VI and VII in permanent vegetation, consider establishing vegetation in alternating strips with half established one year and the remainder established the following year. Leave existing land undisturbed in the alternate strips.

In areas where normal farm equipment will not operate, consider using low maintenance vegetation such as pines, shrubs, crown vetch, or sericea lespedeza.

Consider not planting pines on the south side of roads due to ice accumulation and persistence.
Consider spot treating weeds prior to them becoming widely established.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site, recorded, and

filed using the approved specification sheets or narrative statements in the conservation plan.

A. **Shaping**

1. **Condition Where Shaping Applies**

Shaping applies to areas that are too steep or irregular to stabilize using the desired type vegetation.

Where land slopes exceed 35 percent or gully depths exceed eight feet, gullied areas will be stabilized using vegetation only, such as trees or by shaping and vegetating in conjunction with other structural measures. If significant shaping is needed, stockpile surface soil "topsoil" for spreading on the surface after shaping is complete. Strive to cover the disturbed area with two or more inches of surface soil.

2. **Design**

The shaped area shall have sufficient capacity to carry the 10-year, 24-hour runoff from the drainage area above at a non-eroding velocity after the establishment of vegetation.

Install facilitating practices to address concentrated flow (i.e., diversion, grade structure flow, and waterway). Divert concentrated water away from the treatment area. Drainage area above any single gully shall be limited to the following maximum acreage, according to slope grouping:

- Slopes up to 5 percent - 8 acres.
- Slopes 5 percent to 8 percent, inclusive – 4 acres.
- Slopes over 8 percent, but not exceeding 20 percent – 1 acre.

Depending on area of protection, diversion design is 2 to 25 years. Diversions may be used to protect shaped areas and to reduce the drainage area where suitable outlets are available. Concentrated flow areas will be designed using Grassed Waterway (Code 412) standard.

It is not always practicable to use field surveys to determine the final shaped configuration of gullies for the purpose of developing a design with non-erosive velocities. The determination as to whether or not a gullied area of this type can be shaped to carry runoff at non-erosive velocities will be made by the technician, using his technical judgment, based on the results obtained from work with similar slopes and soils. Exhibit 7-3 in the Engineering Field Manual should be used as a guide when selecting permissible velocities.

3. **Construction**

Complete shaping just prior to or during the seeding dates for the planned vegetation.
All brush, stumps, logs, and other debris shall be removed from the gully prior to shaping. This material may be utilized for building brush dams below the treated area, where needed. In case water overflows the brush dam, construct the top so water will be released in the most stable area. Trees shall be removed, if they

interfere with shaping and vegetation of the site. Minimize impact within the drip line (i.e., cutting roots and filling).

Shaped areas must be protected from livestock while vegetation is being established. Typically, this is 45 days or more [see Begin Grazing Heights listed in Prescribed Grazing (Code 528A) standard].

B. **Standard Planting Methods:**

Seedbed Preparation: Till and cultipack to provide a smooth, firm seedbed. On borrow areas only, subsoil all compact or dense areas before preparing seedbed.

Lime and Fertilizer: Apply lime and fertilizer as guided by the University of Tennessee soil test. In the absence of a soil test, apply fertilizer according to accompanying table. Apply 2 tons of agricultural limestone and, where practical, incorporate lime in the top 4 to 6 inches.

Seeding: Distribute the seed uniformly by drilling, broadcasting, or hydroseeding. If seed is broadcast, cover by cultipacking across the slope. Do not cover if seeded with a hydro-seeder.

Establish a temporary cover crop or mulch the area, if seeding dates are not conducive to seeding perennial vegetation. The cover crop can serve as mulch for the site.

Irrigation: Where available and if needed, apply water to ensure establishment. Do not allow irrigation water to run off. Planting dates for cool season plantings may be extended 15 days later in the spring. For fall plantings, seedings can be made 15 days earlier. Warm season plantings can be planted 30 days later with irrigation.

Mulch: Mulch

- All areas steeper than 5 percent.
- Concentrated flow areas.
- Cut slopes.

Mulch may be omitted in areas with three or more inches of topsoil, if not in one of the above categories.

Apply evenly 1 1/2 tons of dry straw mulch per acre, 2 tons of dry hay per acre, 3 tons of dry seed-bearing sericea lespedeza hay or native grass hay per acre. Mulch made from wood, paper, or plant fibers shall be applied at the rate of 2,000 pounds per acre, or as recommended by the product manufacturer. Cover 50 to 70 percent of the surface with mulch material.

If mulch alone is used to stabilize an area until the perennial seeding is made, the required coverage is 100 percent.

Annuals, temporary cover seeded alone can be grown to produce mulch for the following perennial planting. Mulch is needed when doing a companion planting.

Where ornamentals or ground covers are planted, apply pine straw or pine bark at a thickness of 3 inches. Other suitable material in sufficient quantity may also be used on these sites.

Avoid materials containing noxious weeds. Apply mulch by hand or with a mulch-spreading machine. Temporary cover may be substituted for the mulch, if adequate amounts of vegetation are produced to provide a 50 to 70 percent mulch cover.

Hydroseeding shall be done in two separate operations with seed and fertilizer applied in the first pass and mulch applied in the second pass. Hydroseeded sites flatter than ¾ to 1, use 500 lbs. per acre and on sites ¾ to 1 and steeper use 1,000 lbs. (or as recommended by the product manufacturer) wood cellulose mulch, wood pulp fiber, or other suitable mulch material spread uniformly. The fibers will have a contrasting color to the soil to allow visual metering and aid in uniform application during seeding. Follow with 2 tons/acre of dry straw or 2 ½ tons/acre of dry hay.

Block sod, soil retention blankets, erosion control netting, or other manufactured materials may be required, in addition to mulch due to unstable soils and concentrated flow areas. Blankets, netting, and other materials must be anchored properly.

Exceptions to areas requiring mulching are:

- Where other existing vegetative material will hold seed in place.
- Where rocky or gravelly surfaces will catch and lodge seed.
- In flood-prone areas, the conservationist will determine if mulch will be anchored or not applied.

Topdress: Vary application rate of N according to the stand of legumes (30 percent or greater legumes, N may be omitted, sericea does not provide N to companion grass) and desired production. Late summer application of N does not decrease the stand of legumes. See attached table.

Maintenance: Apply maintenance fertility and lime according to The University of Tennessee soil test recommendations or apply according to the attached table. Mow or use recommended herbicides to control unwanted weeds. Do not mow crown vetch. Mow shrub lespedeza when dormant.

Plant Materials: See the National Range and Pasture Handbook, Chapter 3, for adaptability of species to the site conditions.

Plant materials not to be used on concentrated water areas are: sericea alone or in a mix, shrub lespedeza, native grass, or trees.

In actively eroding gullied areas, check dams of brush, rock, wire, or combinations of such material are usually needed. Live dams of drought resistant grasses (weeping lovegrass, switchgrass or other native grass, bermudagrass), and/or legumes (sericea), or shrubs (bicolor lespedeza) may be used. Plant a band at least 3 feet wide completely across gully channel. Live dam plantings should be fertilized at seeding time with approximately 1 pound per 100 square feet of a complete fertilizer such as 12-24-24 and annually for several years to maintain effective growth. Attempt to protect living plants or trees in the critical area.

Sod: Sod quality and treatment - Sod shall be at least one year old, but not older than three years old. Tall fescue, tall fescue mixes, and bermudagrass are typically used. Sod shall be of uniform thickness of ¾ inch, plus or minus ¼ inch. Measurement of thickness shall exclude top growth or thatch.

Standard size sections of sod shall be strong enough to support their own weight and retain their shape when suspended vertically with a firm grasp of the upper 10 percent of the section.

Sod shall be harvested, delivered, and installed within a period of 36 hours. Sod not transplanted within this period shall be

inspected and approved prior to its installation.

The optimum planting period is in early fall followed by the spring planting period. Sod may be planted during the normal seeding dates and one month later in the summer or one month earlier in the fall if irrigation is provided.

Installation - Prior to sodding, the soil surface shall be cleared of roots, brush, trash, debris, and other objects that would interfere with planting. Based on the University of Tennessee soil test, lime and fertilizer shall be evenly applied as needed, and mixed into the top 3 inches of soil. The site shall then be raked smooth in preparation for laying the sod.

Lightly water immediately prior to laying the sod. Sod strips shall be laid lengthwise on the contour beginning at the base of the slope and working up. On steep slopes the use of ladders will facilitate the work and prevent damage to the sod.

Stagger rows with joints butted tightly together to prevent voids. Sod shall be rolled or tamped immediately following placement. Sod shall not be overlapped. On slopes greater than 3:1, sod shall be secured to the soil surface with pegs or staples.

Where surface water cannot be diverted from flowing over the face of a sodded slope, a capping strip of heavy jute or plastic netting, properly secured, shall be installed along the crown of the slope and edges to provide extra protection against lifting and undercutting of sod. Water carrying channels will be treated in the same way.

Immediately following installation, sod shall be watered until moisture penetrates the soil layer beneath the sod to a depth of 4 inches. Maintain optimum moisture for at least two (2) weeks by lightly watering the sod on a regular (usually daily) basis, unless sufficient rainfall has occurred. Do not allow sod to dry out completely. After the sod begins to take root, reduce frequency of watering and increase the amount of water applied per watering.

Bermudagrass Sod Bags or Grass Seeded Bags: (Applies to road ditches and gully channels or minor widths – one to two bag widths. Bermudagrass sod bags are preferred over placing seed of grasses such as fescue in bags of soil and coarse mulch material. In some locations, Bermudagrass sod may not be available, and placing seed in the bag with the soil and mulch material is an alternative.)

Planting Dates:

Bermudagrass Sod Bags	March 1 to July 15
Bermudagrass Seeded Bags	April 1 to June 15
Tall Fescue Seeded Bags	Fall-Aug. 15-Oct. 15 Spring-Feb. 20-April 1

Planting Method:

Bermudagrass Sod: Fill burlap or mesh bags 2/3 full of soil and Bermudagrass roots and chunks. Mix 1 to 1 ½ pounds of 6-12-12 or 15-15-15 per bag when bagging sod. Place bags about 10 to 20 feet apart in bottom of scouring road ditches or small gullies. Bags should cover flow area in gully bottom. Stake bags in place unless water flow is only moderate. Where open mesh bags are not used, make a few short cuts or slits in top of bag to facilitate early growth

Bermudagrass or Tall Fescue Seeded Bags: Fill bags 2/3 full of soil mixed with fescue hay or similar coarse mulch material, 1 ounce of tall fescue seed, or ½ ounce of

hulled Bermudagrass seed and 1 to 1 ½ pounds of 6-12-12 or 15-15-15 per bag. Place bags and treat as outlined above for Bermudagrass sod bags.

Topdressing: Scatter a handful of ammonium nitrate on each bag, when grass begins to make good growth.

Maintenance: Apply a complete fertilizer, as needed, during succeeding years to promote growth in bottom of scour area. Use additional Bermudagrass sod or grass-seeded bags as needed, if first treatment is inadequate to heal scouring areas.

C. **Land Capability Classes VI and VII Being Cropped**

See above recommendations for seedbed preparation, seeding methods, mulch, and irrigation. See table for recommended Planting Dates, Rates, Lime and Fertilizer, Topdressing, and additional maintenance information.

Seeding Rates:

1.	Tall Fescue	30 lbs./acre
2.	Tall Fescue and White Clover	25 lbs./acre 2 lbs./acre
3.	Hulled Bermudagrass Seed	15 lbs./acre
4.	Bermudagrass Sprigs	30 cu. ft./acre
5.	Sericea and Tall Fescue	30 lbs./acre (Scarified Seed) 10 lbs./acre (Scarified Seed)
6.	Sericea	35 lbs./acre (Scarified Seed)
7.	Fall Seed Sericea and Tall Fescue	50 lbs./acre (Unscarified Seed)

Mulch – Apply mulch as described in "A" on all extremely eroded and/or droughty sites within the critical area and on concentrated flow areas on which erosion may occur before vegetative cover can be established.

OPERATION AND MAINTENANCE

Use of the area shall be managed as long as necessary to stabilize the site and achieve the intended purpose.

Inspections, reseeding, or replanting, fertilization, and pest control may be needed to ensure that this practice functions as intended throughout its expected life. Replanting should be done where needed within one year after original planting. Mulching may also be needed after initial planting, if serious erosion persists.

If rills or small gullies developed during establishment, but surrounding vegetation is well established, disk edge of the gully so sod falls in the gully and walk the sod in with tires. Hand placement of sod prior to walking it in is beneficial.

Control or exclude pests that will interfere with the timely establishment of vegetation.

Comply with all applicable federal, state, and local laws and regulations.

Grasses and Legumes

After one full year from planting all areas with less than 80 percent cover shall be replanted according to the following recommendations:

1. Stands less than 50 percent ground cover, reestablish following the original lime, fertilizer, and seeding recommendations. Consider overseeding a compatible species which matches the site conditions.

2. Stands between 50 and 79 percent ground cover reestablish using half of the original lime, fertilizer, and seeding recommendations. Consider overseeding a compatible species which matches the site conditions.

REFERENCES

Barnes, Robert F., Darrell A. Miller, C. Jerry Nelson. Forages. Fifth Edition, Vol. 1. "An Introduction to Grassland Agriculture."

The University of Tennessee, Agricultural Extension Service. PB-378. Field Crop Seeding Guide. http://www.utextension.utk.edu/publications/pbfiles/pb378.pdf

PERENNIAL SEEDING RECOMMENDATIONS:

Species	Planting Date	Seeding Rate/ Acre	Lime* and Fertilizer	Topdress with Nitrogen	Maintenance Fertilizer	Remarks
Tall Fescue	Acceptable: 8/15-10/15 2/20-4/1 Optimum: 8/15-9/15	50 lbs.	60-120-120	45 lbs. following growing season 3/1, 4/15, or 9/1. Repeat as needed.	45-45-45	Excellent erosion control. Poor wildlife habitat.
Tall Fescue White Clover	Acceptable: 8/15-10/15 2/20-4/1 Optimum: 8/15-9/15	40 lbs. 2 lbs.	30-120-120	30% or more legume. Omit nitrogen.	45-45-45	Good erosion control. Not recommended on areas of concentrated flow. Poor wildlife habitat
Reed Canarygrass	Acceptable: 8/15-10/15 2/20-4/1 Optimum: 8/15-9/15	25 lbs. or 15 lbs. w/ 2 lbs. white clover	60-120-120	45 lbs. following growing season 3/1, 4/15, or 9/1.	45-45-45	Excellent erosion control. Aggressive and invasive. Do not use on waterways with less than 3% slope or banks of low velocity streams. Slow to establish.
Hulled Bermudagrass Seed	Acceptable: 4/15-7/1 Optimum: 5/1-6/20	10 lbs 15 lbs. on steep banks.	60-120-120 topdress with 45 lbs. of N 2 months after seeding	After seeding 45 lbs. every 30 days to 60 days as needed.	60-60-60	Excellent erosion control. Poor wildlife habitat. Aggressive and invasive. Fertility management is important for longevity.
Bermudagrass Sprigs or Clippings with Vaughn's No. 1	Acceptable: 4/15-7/1 Optimum: 5/1-6/20	50 cu. ft.	60-120-120 topdress with 45 lbs. of N 2 months after sprigging	After established 45 lbs every 30 days to 60 days as needed.	60-60-60	Excellent erosion control. Poor Wildlife habitat. Aggressive and invasive. Fertility management is important for longevity.
Sericea with Tall Fescue	Acceptable: 3/15-6/1 Optimum for mix: 4/1-5/15. Ideal to plant sericea first 3/15-6/1 and tall fescue following fall 9/15-10/15	40 lbs. sericea plus 20 lbs. tall fescue	30-120-120	45 lbs. following growing season 3/1, 4/15, or 9/1. Repeat as needed. Sericea does not provide nitrogen for the associative grass.	30-60-60	Excellent erosion control, poor wildlife habitat. Aggressive and invasive. Ideally seed sericea in spring and no-till drill tall fescue in late summer. Avoid areas of concentrated flow. Consider using inoculant with sericea on disturbed sites. Frequent clipping should be avoided. Excessive grazing or clipping is harmful. Do not clip between Sept. 1 and the first killing frost.

PERENNIAL SEEDING RECOMMENDATIONS CONTINUED:

Species	Planting Date	Seeding Rate/ Acre	Lime* and Fertilizer	Topdress with Nitrogen	Maintenance Fertilizer	Remarks
Sericea with Tall Fescue Fall Seeding	Acceptable: 8/15-10/15 Optimum: Plant Tall Fescue 8/15-10/15 and Unhulled Sericea 12/1-2/15	40-80 lbs. sericea (combine run) plus 20 lbs. tall fescue	30-120-120	45 lbs. following growing season 3/1, 4/15, or 9/1. Repeat as needed. Sericea does not provide nitrogen for the associative grass.	30-60-60	Excellent erosion control. Aggressive and invasive. Ideally seed sericea in spring and no-till drill tall fescue in sericea in late summer. Do not use on areas of concentrated flow. Poor wildlife habitat.
Sericea with Bermudagrass or Lovegrass	4/1-6/15	40 lbs. of sericea and 5 lbs. bermudag rass, or 3 lbs. weeping lovegrass	30-120-120	After seeding 45 lbs. every 30 to 60 days as needed. Sericea does not provide nitrogen for the associative grass.	40-80-80	Excellent erosion control. Aggressive and invasive. Poor wildlife habitat. Seed sericea and grass at the same time.
Native Grass Mix (Big Bluestem, Little Bluestem, and Indiangrass	Acceptable: 4/15-7/1 Optimum: 4/15-5/30 Dormant Plantings: 12/1-2/15 (planted with full rate “alone rate” of winter annual)	15 lbs. (5 lbs. of each)	0-60-60 topdress with 45 lbs. of N after established	After weed competition is controlled and 1 or more plants are present per 2.5 sq. ft. topdress with 30 to 45 lbs. of nitrogen.	45-45-45	Avoid slopes greater than 8% in West TN. Avoid slopes greater than 12% in East and Middle TN. Avoid areas of concentrated flow.
Switchgrass	Acceptable: 4/15 to 7/1	15 lbs.	0-60-60 Topdress with 45 lbs. of N after established.	After weed competition is controlled and one or more plants are present per 2.5 square feet, topdress with 30 to 45 lbs. of nitrogen.	45-45-45	Avoid slopes greater than 8% in West TN. Avoid slopes greater than 12% in East and Middle TN. Avoid areas of concentrated flow.

PERENNIAL SEEDING RECOMMENDATIONS CONTINUED:

Species	Planting Date	Seeding Rate/ Acre	Lime* and Fertilizer	Topdress with Nitrogen	Maintenance Fertilizer	Remarks
Switchgrass Kobe or Korean Lespedeza	Acceptable: 4/15 to 7/1 Optimum: 4/15-5/30	10 lbs. 5 lbs.	0-60-60 Topdress with 45 lbs of N after established.	After weed competition is controlled and one or more plants are present per 2.5 sq. ft., topdress with 30 to 45 lbs. of nitrogen.	45-45-45	Well suited to dikes and berms. Substitute lespedeza with Japanese millet on wetter sites.
Trees (Black Locust, Loblolly, Virginia, White, or Shortleaf)	Acceptable: 11/1-4/1 Optimum: 2/15-4/1	6' x 6' spacing (1,210 plants/ acre)	0-60-60	If trees are yellow and stunted, apply 50-50-50.	0-60-60	Protect area from fire and grazing. Do not prune trees. White pine may be used at elevations above 2,500 feet. Do not plant shortleaf pine on clayey sites. Plant trees 2 or 3 feet back from edge of a steep gully wall. Loblolly pine is preferred for planting on sites where silting can be expected. Roots should be planted straight down, not twisted, balled, or J-shaped. Pack soil firmly around the planted seedlings to remove air pockets.
Crownvetch seeded with Tall Fescue or Other Cool Season Grasses	8/15-9/15	15 lbs. crown vetch 30 lbs. tall fescue	30-60-60	0	0–60-60	Do not mow. If seeded with a hydraulic seeding machine and mixed with fertilizer in slurry mixture, the amount of inoculant used shall be increased by ten times the usual recommended rate.
Crownvetch (Plants) with Tall Fescue or Other Cool Season Grasses	Plants: 2/20-4/1 11/15-1/1 Seed: 3/1-4/15 8/15-9/15	1 plant per square yard with 30 lbs. tall fescue	30-60-60	0	0-60-60	Ensure the roots are straight.

PERENNIAL SEEDING RECOMMENDATIONS CONTINUED:

Species	Planting Date	Seeding Rate/ Acre	Lime* and Fertilizer	Topdress with Nitrogen	Maintenance Fertilizer	Remarks
Shrub Lespedezas	4/1-7/15	40 lbs. of scarified shrub lespedeza	60-120-120	0	50-100-100	
Weeping Lovegrass (in mixture)	4/1-6/15	3 lbs.	Good drought tolerance, good companion grass, do not seed alone			

TEMPORARY COVER (Use when outside of perennial seeding dates, temporary cover can provide mulch for the following perennial planting; mulch alone is an alternative, see mulch section.)

Species	Planting Date	Seeding Rate/Acre	Lime* and Fertilizer	Remarks
Wheat	9/1-11/10	Alone 3 bushels In mix ¼ bushel	45-45-45	Winter hardy.
Rye	8/15-11/10	Alone 3 bushels In mix ¼ bushel	45-45-45	Quick cover, drought tolerant and most winter hardy small grain.
Ryegrass Do not use in seeding mixtures.	8/15-10/10	Alone 40 lbs. Do not use in seeding mixtures.	45-45-45	Do not use in seeding mixtures. Provides dense cover and is very competitive. Easy to establish. Can be a problem in future seedings.
Barley	9/1-10/1	Alone 3 bushels In mix ¼ bushel	45-45-45	Use on productive soils where topsoil is present.
Oats	9/1-10/1 2/20-3/15	Alone 4 bushels In mix 1/3 bushel	45-45-45	Use on productive soils where topsoil is present. Not as winter hardy as other small grains.
German Millet (Foxtail)	5/1- 7/15	Alone 40 lbs. In mix 5 lbs.	60-60-60	Extremely drought tolerant, germinates in < 7 days. Light residue.
Browntop Millet	5/1-7/15	Alone 40 lbs. In mix 5 lbs.	60-60-60	Very drought tolerant, light residue.
Pearl Millet	5/1-7/15	Alone 20 lbs. In mix 5 lbs.	60-60-60	Very drought tolerant, moderate residue.
Sorghums	4/20-7/15	Alone 45 lbs. In mix 5 lbs.	60-60-60	Drought tolerant, heavy residue.

* In the absence of a soil test, apply 2 tons/acre at establishment and 1 ton/acre every 5 years.